

CLAIMS

What is claimed is:

1 1. A method of forming a coating onto a surface of a prosthesis,
2 comprising the acts of:

3 (a) providing a composition; and
4 (b) depositing said composition in a preselected geometrical pattern
5 onto a first surface of said prosthesis to form said coating.

1 2. The method of Claim 1, wherein said prosthesis is a stent having a
2 plurality of struts.

1 3. The method of Claim 2, wherein said stent is selected from a group
2 of balloon-expandable stents and self-expandable stents.

1 4. The method of Claim 1, wherein said composition comprises a
2 polymer.

1 5. The method of Claim 4, wherein subsequent to said act of
2 depositing said composition, the method additionally comprises the act of heating
3 said polymer.

1 6. The method of Claim 4, wherein said composition additionally
2 comprises a therapeutic substance.

1 7. The method of Claim 6, wherein said polymer constitutes from
2 about 50% to about 99.9% by weight of the total weight of said composition and
3 said therapeutic substance constitutes from about 0.1% to about 50% by weight of
4 the total weight of said composition.

1 8. The method of Claim 6, wherein said therapeutic substance is
2 selected from a group of antineoplastic, antiinflammatory, antiplatelet,
3 anticoagulant, antifibrin, antithrombin, antimitotic, antiproliferative, antibiotic,
4 antioxidant, antiallergic substances, and combinations thereof.

1 9. The method of Claim 4, wherein said composition additionally
2 comprises a solvent.

1 10. The method of Claim 9, wherein said polymer constitutes from
2 about 0.1% to about 25% by weight of the total weight of said composition and
3 said solvent constitutes from about 75% to about 99.9% by weight of the total
4 weight of said composition.

1 11. The method of Claim 9, wherein said method additionally
2 comprises the act of removing essentially all of said solvent from said composition
3 on said prosthesis.

1 12. The method of Claim 6, wherein said composition additionally
2 comprises a solvent.

1 13. The method of Claim 12, wherein said polymer constitutes from
2 about 0.1% to about 25% by weight of the total weight of said composition, said

3 solvent constitutes from about 50% to about 99.8% by weight of the total weight of
4 said composition and said therapeutic substance constitutes from about 0.1% to
5 about 50% by weight of the total weight of said composition

1 14. The method of Claim 12, wherein said method additionally
2 comprises the act of removing essentially all of said solvent from said composition
3 on said prosthesis.

1 15. The method of Claim 1, wherein said composition comprises a
2 therapeutic substance.

1 16. The method of Claim 15, wherein said therapeutic substance is
2 selected from a group of antineoplastic, antiinflammatory, antiplatelet,
3 anticoagulant, antifibrin, antithrombin, antimitotic, antiproliferative, antibiotic,
4 antioxidant, antiallergic substances, and combinations thereof.

1 17. The method of Claim 15, wherein said composition additionally
2 comprises a solvent.

1 18. The method of Claim 17, wherein said therapeutic substance
2 constitutes from about 0.1% to about 50% by weight of the total weight of said
3 composition, said solvent constitutes from about 50% to about 99.9% by weight of
4 the total weight of said composition.

1 19. The method of Claim 17, wherein said method additionally
2 comprises the act of removing essentially all of said solvent from said composition
3 on said prosthesis.

1 20. The method of Claim 1, wherein said composition comprises a
2 monomer.

1 21. The method of Claim 20, wherein subsequent to said act of
2 depositing said composition, the method additionally comprises the act of curing
3 said monomer to form a polymeric coating.

1 22. The method of Claim 20, wherein said composition additionally
2 comprises a therapeutic substance.

1 23. The method of Claim 22, wherein subsequent to said act of
2 depositing said composition, the method additionally comprises the act of curing
3 said composition to form a polymeric coating.

1 24. The method of Claim 22, wherein said monomer constitutes from
2 about 50% to about 99.9% by weight of the total weight of said composition and
3 said therapeutic substance constitutes from about 0.1% to about 50% by weight of
4 the total weight of said composition.

1 25. The method of Claim 22, wherein said therapeutic substance is
2 selected from a group of antineoplastic, antiinflammatory, antiplatelet,
3 anticoagulant, antifibrin, antithrombin, antimitotic, antiproliferative, antibiotic,
4 antioxidant, antiallergic substances, and combinations thereof.

1 26. The method of Claim 20, wherein said composition additionally
2 comprises a solvent.

1 27. The method of Claim 26, wherein said monomer constitutes from
2 about 0.1% to about 50% by weight of the total weight of said composition and
3 said solvent constitutes from about 50% to about 99.9% by weight of the total
4 weight of said composition.

1 28. The method of Claim 26, wherein said method additionally
2 comprises the act of removing essentially all of said solvent from said composition
3 on said prosthesis.

1 29. The method of Claim 22, wherein said composition additionally
2 comprises a solvent.

1 30. The method of Claim 29, wherein said method additionally
2 comprises the act of removing essentially all of said solvent from said composition
3 on said prosthesis.

1 31. The method of Claim 29, wherein said monomer constitutes from
2 about 0.1% to about 49.9% by weight of the total weight of said composition, said
3 therapeutic substance constitutes from about 0.1% to about 50% by weight of the
4 total weight of said composition, and said solvent constitutes from about 49.9% to
5 about 99.8% by weight of the total weight of said composition.

1 32. The method of Claim 1, wherein said act of depositing said
2 composition in a preselected geometrical pattern comprises the act of:
3 moving a dispenser assembly along a predetermined path while
4 depositing said composition onto a stationary prosthesis.

1 33. The method of Claim 1, wherein said act of depositing said
2 composition in a preselected geometrical pattern comprises the act of:

3 moving a holder assembly supporting said prosthesis along a
4 predetermined path while a stationary dispenser assembly deposits said
5 composition onto said prosthesis.

1 34. The method of Claim 1, wherein said act of depositing said
2 composition in a preselected geometrical pattern comprises the acts of:

3 moving a holder assembly supporting said prosthesis along a first
4 predetermined path; and
5 moving a dispenser assembly along a second predetermined path.

1 35. The method of Claim 1, wherein said preselected geometrical
2 pattern is a continuous stream.

1 36. The method of Claim 35, wherein said continuous stream is formed
2 in a pattern selected from a group of a straight line, a curved line, and an angular
3 line.

1 37. The method of Claim 1, wherein said preselected geometrical
2 pattern is an intermittent pattern of said composition.

1 38. The method of Claim 37, wherein said intermittent pattern is formed
2 in a pattern selected from a group of a straight line, a curved line, and an angular
3 line.

1 39. The method of Claim 37, wherein said intermittent pattern includes
2 beads.

1 40. The method of Claim 1, wherein said prosthesis contains a channel
2 and extending from a first position along said first surface to a second position
3 along said first surface and wherein said act of depositing said composition in a
4 preselected geometrical pattern comprises depositing said composition at least
5 partially within said channel.

1 41. The method of Claim 2, wherein at least one strut of said plurality
2 of struts contains a channel and extending from a first position along said at least
3 one strut to a second position along said at least one strut and wherein said act of
4 depositing said composition in a preselected geometrical pattern comprises
5 depositing said composition at least partially within said channel.

1 42. The method of Claim 1, wherein said prosthesis contains a first
2 cavity within said first surface and wherein said act of depositing said composition
3 in a predetermined geometrical pattern comprises the act of depositing said
4 composition at least partially within said first cavity.

1 43. The method of Claim 42, wherein said predetermined geometrical
2 pattern is a bead having a bead diameter.

1 44. The method of Claim 2, wherein at least one strut of said plurality
2 of struts contains a first cavity and wherein said act of depositing said composition
3 in a predetermined geometrical pattern comprises the act of depositing said
4 composition at least partially within said first cavity.

1 45. The method of Claim 1, wherein said composition is a first
2 composition, said method additionally comprising the act of:

3 depositing a second composition in a preselected geometrical
4 pattern onto said prosthesis.

1 46. The method of Claim 1, wherein, after said act of depositing said
2 composition, the method additionally comprises the act of:

3 redistributing said composition from said first surface to a second
4 surface of said prosthesis.

1 47. The method of Claim 46, wherein said act of redistributing said
2 composition is accomplished using air pressure.

1 48. The method of Claim 46, wherein said act of redistributing said
2 composition is accomplished using centrifugal force.

3

1 49. The method of Claim 46, wherein said act of redistributing said
2 composition is accomplished using a low viscosity solvent, wherein said low
3 viscosity solvent is applied to said composition on said first surface of said
4 prosthesis to dilute said composition thereby allowing said composition to flow
5 from said first surface to said second surface of said prosthesis.

1 50. An apparatus for depositing a composition onto a surface of a
2 prosthesis comprising:

3 (a) a dispenser assembly having a nozzle for depositing a
4 composition onto a surface of a prosthesis;

5 (b) a holder assembly for supporting a prosthesis; and

6 (c) a motion control system for either

7 i) moving said dispenser assembly along a

8 predetermined path or

9 ii) moving said holder assembly along a predetermined

10 path.

1 51. The device of Claim 50, wherein said dispenser assembly can
2 deposit said composition in a preselected geometrical pattern onto said surface of
3 said prosthesis.

1 52. The device of Claim 51, wherein said dispenser assembly is an
2 inkjet printhead.

1 53. The device of Claim 51, wherein said dispenser assembly is a
2 microinjector.

1 54. The device of Claim 53, wherein said microinjector has an injection
2 volume ranging between approximately 2 nL and approximately 70 nL.

1 55. The device of Claim 70, wherein said prosthesis is a stent having a
2 plurality of struts.

1 56. The device of Claim 55, wherein said dispenser assembly can
2 deposit said composition in a preselected geometrical pattern onto at least one strut
3 of said plurality of struts.

1 57. The device of Claim 51, wherein said preselected geometrical
2 pattern is a continuous stream starting at a first selected position on said surface of
3 said prosthesis and ending at a second selected position on said surface of said
4 prosthesis, said continuos stream having a selected stream width.

1 58. The device of Claim 57, wherein said continuous stream is formed
2 in a pattern selected from a group of a straight line, a curved line, and an angular
3 line.

1 59. The device of Claim 51, wherein said preselected geometrical
2 pattern is an intermittent pattern.

1 60. The device of Claim 59, wherein said intermittent pattern is formed
2 in a pattern selected from a group of a straight line, a curved line, and an angular
3 line.

1 61. The device of Claim 50, wherein said dispenser assembly can
2 deposit said composition in a preselected geometrical pattern at least partially
3 within a channel and extending from a first position to a second position along said
4 surface of said prosthesis.

1 62. The device of Claim 50, wherein said dispenser assembly can
2 deposit said composition in a preselected geometrical pattern at least partially
3 within at least one cavity in said surface of said prosthesis.

1 63. The device of Claim 62, wherein said preselected geometrical
2 pattern is deposited at least partially within each of said at least one cavity in said
3 surface of said prosthesis.

1 64. The device of Claim 62, wherein said preselected pattern is
2 deposited at least partially within some but not all of said at least one cavity in said
3 surface of said prosthesis.

1 65. The device of Claim 50, wherein said dispenser assembly can
2 deposit a second composition in a preselected geometrical pattern onto said surface
3 of said prosthesis.

1 66. The device of Claim 50, wherein said nozzle is a first nozzle for
2 depositing a first composition and wherein said dispenser assembly additionally
3 has a second nozzle for depositing said second composition.

1 67. The device of Claim 50, wherein said nozzle has an orifice having
2 an orifice diameter in the range of approximately 0.5 microns to approximately 150
3 microns.

1 68. The device of Claim 50, wherein said nozzle has an orifice that can
2 capture a last droplet of said composition to prevent lifting of said last droplet from
3 said prosthesis.

1 69. The device of Claim 50, wherein said nozzle can be positioned at a
2 90° angle with respect to said prosthesis during deposition of said composition onto
3 said prosthesis.

1 70. The device of Claim 50, wherein said nozzle can be positioned at an
2 angle less than 90° with respect to said prosthesis during deposition of said
3 composition onto said prosthesis.

1 71. The device of Claim 50, wherein said dispenser assembly is coupled
2 to a delivery control system.

1 72. The device of Claim 71, wherein said delivery control system is in
2 communication with a CPU.

1 73. The device of Claim 50, wherein said motion control system is for
2 moving said dispenser assembly along a predetermined path.

1 74. The device of Claim 73, wherein said motion control system can
2 move said dispenser assembly along said predetermined path in a direction selected
3 from a group of along the x-axis, along the y-axis, along the z-axis, rotational, or a
4 combination thereof.

1 75. The device of Claim 73, wherein said holder assembly remains
2 stationary.

1 76. The device of Claim 73, wherein said dispenser assembly is coupled
2 to said motion control system through a driving component.

1 77. The device of Claim 50, wherein said motion control system is for
2 moving said holder assembly along a predetermined path.

1 78. The device of Claim 77, wherein said motion control system can
2 move said holder assembly along said predetermined path in a direction selected

3 from a group of along the x-axis, along the y-axis, along the z-axis, rotational, or a
4 combination thereof.

1 79. The device of Claim 77, wherein said dispenser assembly remains
2 stationary.

1 80. The device of Claim 77, wherein said holder assembly is coupled to
2 said motion control system through a driving component.

1 81. The device of Claim 77, wherein said motion control system is in
2 communication with a CPU.

1 82. The device of Claim 73, wherein said motion control system is a
2 first motion control system for moving said dispenser assembly along a first
3 predetermined path, and wherein said holder assembly is coupled to a second
4 motion control system for moving said holder assembly along a second
5 predetermined path.

1 83. The device of Claim 82, wherein said holder assembly is coupled to
2 said second motion control system through a driving component.

1 84. The device of Claim 82, wherein said first motion control system
2 can move said dispenser assembly along said first predetermined path in a
3 direction selected from a group of along the x-axis, along the y-axis, along the z-
4 axis, rotational, or a combination thereof and wherein said second motion control
5 system can move said holder assembly along said second predetermined path in a
6 direction selected from a group of along the x-axis, along the y-axis, along the z-
7 axis, rotational, or a combination thereof.

1 85. The device of Claim 82, wherein said second motion control system
2 is in communication with a CPU.

1 86. The device of Claim 50, additionally comprising a feedback system.

1 87. The device of Claim 86, wherein said feedback system comprises:
2 a video camera for capturing an image;
3 a lens system coupled to said video camera;
4 frame grabber hardware to accept said image; and
5 vision software to characterize said image;
6 wherein feedback is provided to direct deposition of said
7 composition onto said surface of said prosthesis.

1 88. The device of Claim 87, wherein said image is of an individual
2 strut.

1 89. The device of Claim 87, wherein said image is of a characteristic of
2 said prosthesis.

1 90. The device of Claim 87, wherein said image is of a unique pattern
2 on said prosthesis.

1 91. The device of Claim 87, wherein said image is of said nozzle
2 relative to a particular location on said prosthesis.

1 92. The device of Claim 87, wherein said feedback is directed to said
2 dispenser assembly.

1 93. The device of Claim 87, wherein said feedback is directed to said
2 holder assembly.